Description

Use of fatty amine salts in combination with fatty acids as reagents for the flotation of potash salts (sylvinite)

The present invention relates to the use of amine salts in combination with fatty acids as flotation reagents in the production of sylvinite, and also to a corresponding reagent.

In the production of sylvinite from crude potash salts which occur, for example, in Germany, Belarus, CIS, Canada and the United States of America, it is necessary in some cases to remove foreign minerals, such as clays, dolomite, anhydride, hematite and other materials, preferably upstream of the flotation separation of sylvinite, from other crude potash salt components. The removal of foreign materials which are customarily termed slimes or insoluble fractions, is carried out by flotation. In flotation processes a crude salt pulp is customarily first subjected to a scrubbing operation to release the insoluble fractions, which are termed hereinafter insoluble fractions, and the cleaned crude salt pulp is then conditioned using one or more reagents which promote the removal of the insoluble fractions. The conditioned pulp is subjected to a froth separation, which removes a part of the insoluble constituents. Flocculants can be used to improve the separation. After the partial removal of the insoluble fractions, customarily an additive (blinding agent) is added to the crude salt pulp to inactivate residues of the insoluble fractions, conditioned with reagents and subjected to the froth separation for production of sylvinite and other crude potash salt components.

Because of numerous advantages, the flotation process for separating potash salt mixtures of natural or industrial origin to form intermediates or potash fertilizers by means of fatty amine collectors is widespread. By adding the fatty amine or salts thereof to the flotation pulp, the mineral component of value becomes hydrophobic and thus capable of being discharged in enriched form in the concentrate and isolated. Obviously, the chemical constitution of the collector, its preparation and the conditions of

its metering have the greatest effect on its adsorption and thus on its action. Generally, primary fatty amines are used. In mixtures with these amines, short-chain alkylamines are used, for example as are present in cocoamine.

DD-B-154 960 discloses a fatty amine for the flotation of potash salts which has virtually saturated alkylamines produced from natural or synthetic starting substances in a ratio of the chain length fragments of $C_{16}$:$C_{18}$:$C_{20}$:$C_{22}$ such as from 10 to 25: from 55 to 70: from 4 to 10: from 5 to 20, preferably 15:65:5:10, and has a content of at least 92% primary amines.

US-4 045 335 discloses a process for the flotation of langbeinite and kieserite in which a reagent is used which, in addition to a fatty amine, preferably tallow fatty amine, also contains oleic acid or decanedioic acid.

It was an object of the present invention to provide a flotation reagent which enhances the KCl recovery in sylvinite flotation without decreasing the concentrate quality.

Surprisingly, it has been found that a mixture of a primary alkylamine salt and a branched fatty acid significantly enhances the flotation recovery compared with conventional collectors. The KCl content of the resultant concentrate produced is not decreased by the higher activity of the novel collector.

The invention thus relates to the use of a mixture of

A) at least one compound of the formula

$$[R^1\text{-}NH_3]^+X^-$$

where $R^1$ is a $C_8$-$C_{22}$ alkyl radical and $X^-$ is an anion, and

B) a branched fatty acid having a chain length of 8 to 22 carbon atoms as collector in sylvinite flotation.

The invention further relates to a process for the flotation of sylvinite, in which the abovedescribed composition is added as collector to the flotation

pulp.

The invention further relates to a composition effective as flotation reagent comprising

A) at least one compound of the formula

$$[R^1\text{-}NH_3]^+X^-$$

where $R^1$ is a $C_8$-$C_{22}$ alkyl radical and $X^-$ is an anion, and

B) a branched fatty acid having a chain length of 8 to 22 carbon atoms.

Substituent A of the inventive composition preferably comprises a radical $R^1$ having a chain length of 12 to 20, in particular 16 to 20, especially 18, carbon atoms. X can be any desired anion, but is preferably a chloride, formate, or acetate anion. A particularly preferred substituent A is stearylamine acetate.

Constituent B of the inventive composition is preferably a branched carboxylic acid having 14 to 22 carbon atoms, in particular isostearic acid. The preferred mixing ratio of A:B is 90:10 to 10:90, in particular 75:25 to 25:75. In a further embodiment, the constituents A and B total 100% by weight.

For simplified handling of the inventive composition, this can be formulated with solvents. Suitable solvents are glycols, in particular butyl polyglycol, the residues from oxoalcohol synthesis, and also if appropriate water as minor constituent.

Residues from oxoalcohol synthesis preferably have the following composition:

| Constituent | Concentration range (% by weight) |
|---|---|
| Di-2-ethylhexyl ether | 10-25 |
| 2-Ethylhexanoic acid 2-ethylhexyl ester | 10-25 |
| $C_{16}$ lactones | 4-20 |
| 2-Ethylhexyl butyrate | 3-10 |
| 2-Ethylhexane-(1,3)-diol mono-n-butyrate | 5-15 |

| | |
|---|---|
| 2-Ethylhexanol | 4-10 |
| $C_4$ to $C_8$ acetals | 2-10 |
| 2-Ethylhexane-(1,3)-diol | 2-5 |
| Ethers and esters ≥ $C_{20}$ | 0-20 |

In a further embodiment of the invention the inventive compositions are used in a mixture with quaternary ammonium salts. Such salts have the formula $[NR^2R^3R^4R^5]^+X^-$, where $R^2$, $R^3$, $R^4$ and $R^5$ are alkyl radicals having 1 to 18 carbon atoms. Preferably, one of the radicals $R^2$ to $R^5$ is a short-chain radical, for example methyl or ethyl, and the other radicals are long-chain radicals having 8 to 18 carbon atoms. Two short-chain radicals can also be combined with 2 long-chain radicals. Suitable anions X are chloride and sulfate.

In a further embodiment of the invention the inventive compositions are used in a mixture with ether propyleneamines of the formula $R^6$-O-$(CH_2)_3$-$NH_2$ and/or ether propylenediamines of the formula $R^6$-O-$(CH_2)_3$-NH-$(CH_2)_3$-$NH_2$. $R^6$ here is an alkyl group having 8 to 18 carbon atoms. It is also possible to use the ether propylene(di)amines in the form of their salts, in particular chlorides, acetates or formates.

The inventive composition is used as a flotation reagent in amounts of preferably 10 to 500, in particular 20 to 200 g/t.

Examples

Hereinafter, the effectiveness of the inventive flotation reagent was determined. Constituent A was stearylamine acetate, constituent B was isostearic acid. The amount used was 40 g/t (t.q.). The mixing ratio A:B was 1:1.

The crude salt was ground and suspended in a saturated salt solution. After addition of the collector, air was forced through the suspension. The salt which was rendered hydrophobic by the collector floats as a result on the surface of the suspension and is skimmed off there. The potassium content of the concentrate thus obtained was determined, and also its ratio to the total amount of potassium present (recovery).

The following results were obtained:

Table 1

| No. | Collector | $K_2O$ in the concentrate | $K_2O$ recovery | $K_2O$ feed |
|---|---|---|---|---|
| 1 (C) | Stearylamine | 48.2 | 77.1 | 9.78 |
| 2 (C) | Stearylamine acetate + $(C_8)_3C$-COOH | 47.2 | 61.7 | 9.78 |
| 3 (C) | Stearylamine acetate + lauric acid | 49.1 | 72.8 | 9.78 |
| 4 | Stearylamine acetate + isostearic acid | 50.8 | 82.0 | 9.78 |
| 5 (C) | Stearylamine acetate + stearic acid | 50.1 | 48.6 | 9.78 |